Why We Need to Strengthen Our Approach to Thermally Activated Technologies

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U.S. Department of Energy
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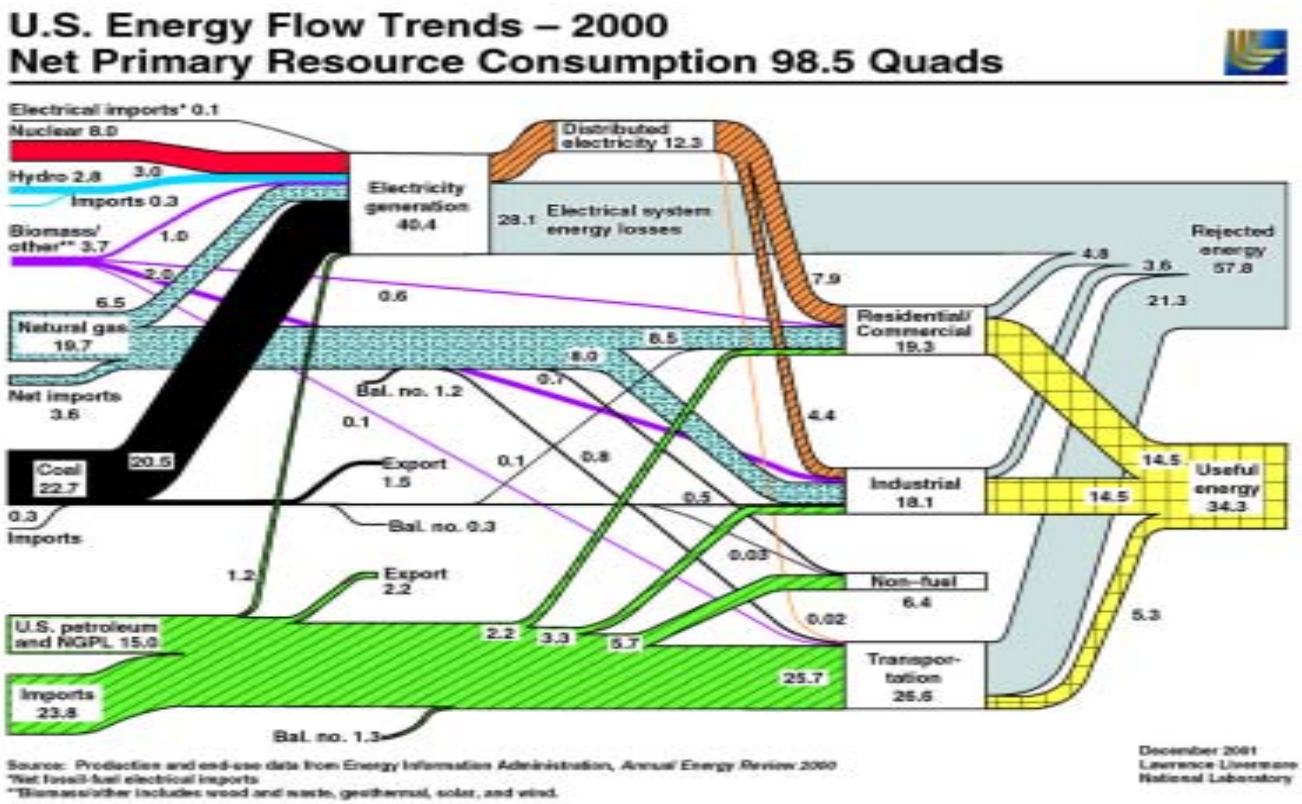
National Needs

Drivers

- Reduce peak electricity demand
- Utilize on-site heat
  - electric generation that would be wasted
  - furnaces
- Improve overall thermal equation
- Improve productivity and performance of buildings and industry

WHY?

Drivers


U.S. Energy Flow Trends – 2000
Net Primary Resource Consumption 98.5 Quads
Electrical imports* 0.1
Nuclear 8.0
Hydro 2.8
3.0
Imports 0.3
Biomass/ other** 3.7
1.0
2.0
6.5
Natural gas 19.7
Net imports 3.6
Coal 22.7
20.5
0.3
Imports
U.S. petroleum and NGPL 15.0
1.2
Imports 23.8
Bal. no. 1.3
Export 2.2
Export 1.5
Bal. no. 0.3
Bal. no. 1.2
0.1
0.1
0.6
Electricity generation 40.4
Distributed electricity 12.3
28.1 Electrical system energy losses
7.9
8.5
8.0
0.7
0.8
0.5
4.4
2.2
3.3
5.7
25.7
0.03
0.02
Residential/ Commercial 19.3
Industrial 18.1
Non-fuel 6.4
Transpor-tation 25.6
4.8
3.6
21.3
Rejected energy 57.8
14.5
14.5
Useful energy 34.3
5.3
Source: Production and end-use data from Energy Information Administration, Annual Energy Review 2000
*Net fossil-fuel electrical imports
**Biomass/other includes wood and waste, geothermal, solar, and wind.
December 2001
Lawrence Livermore
National Laboratory

WHY?

Drivers

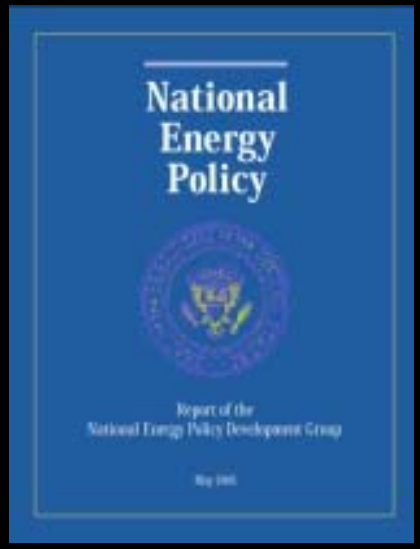
- International Competition
  - Japan
  - China
  - Korea
- Changing Philosophy
  - Distributed vs. central
  - Fuel-fired or Electric

How do we optimize our energy system…..

Guiding Documents

DOE Perspective

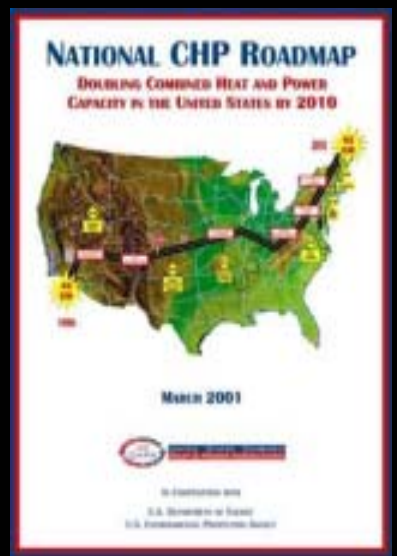
National Energy Policy



National Grid Study

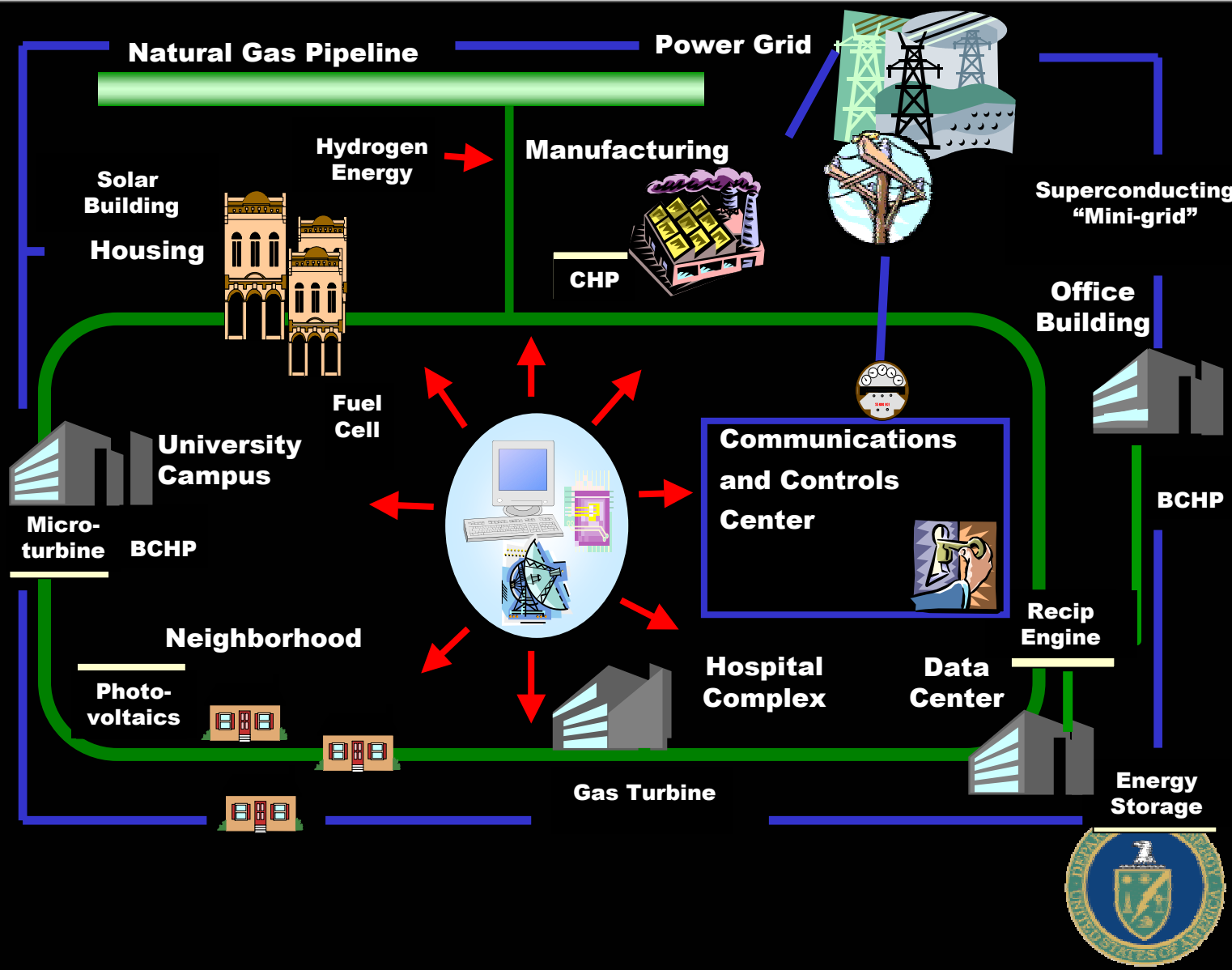
President's Management Agenda

National CHP Roadmap



Distributed Energy Resources

DOE Perspective



Distributed Energy and Electric Reliability Program

DOE Perspective

Technology Development:
Microturbines, Reciprocating Engines, Fuel Cells, Storage

Technology Packages:
Integrated CHP Systems, Chillers, Desiccants

End-Use Integration:
Demand Management, Controls, Sensors

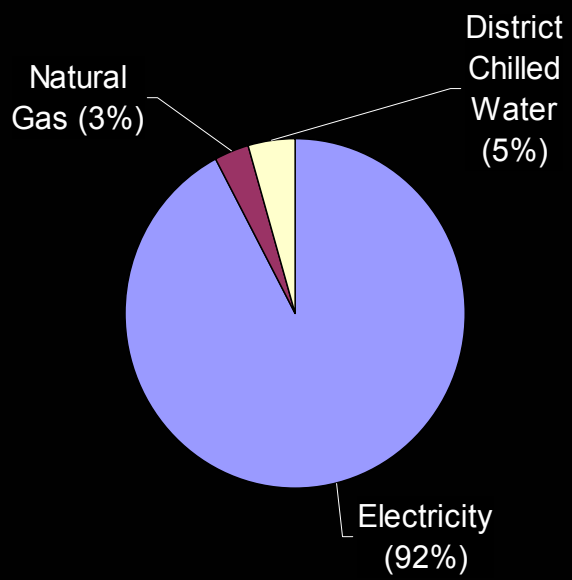
Electric & Gas Integration:
Load Management, Power Electronics

Distribution System:
Power Parks, Microgrids, DC Grids, UPS

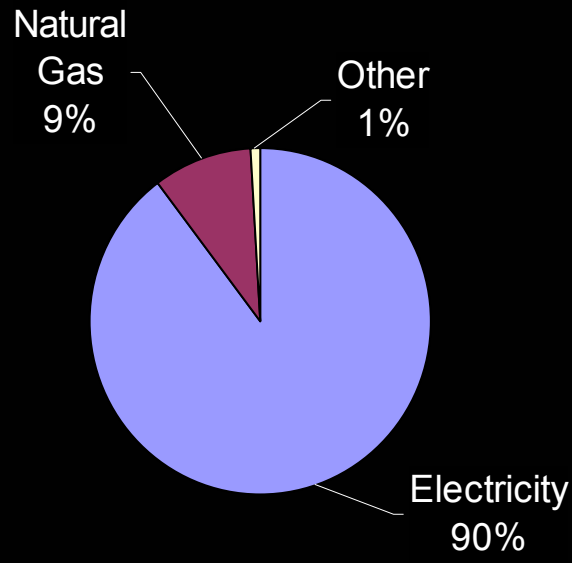
Transmission System:
High-Temperature Superconductivity

Despite Promise, TAT Are Just Scratching Surface

MARKET



Cooling in Buildings
(based on sq ft)
Source: EIA, 1999 CBECS

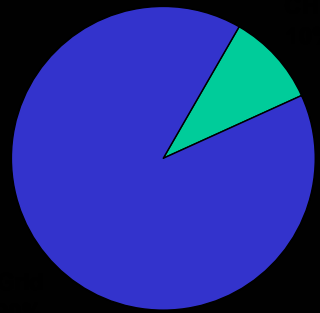


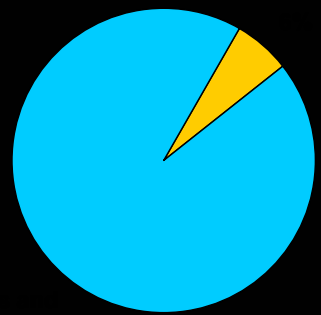
Process Cooling/Refrigeration in Industry
(based on BTU)
Source: EIA, 1998 MECS

CHP Progressing Towards Roadmap Goal

MARKET

- In 2000, CHP installed base reached 67.4 GW
- Net electricity generation amounts to 358 TWh, or about 10 percent of commercial and industrial (C/I) use
- Thermal output of about 1.7 quads, or about 6 percent of C/I use
- Potential to improve use of thermal output by adding TAT to existing systems as well as incorporating in new systems
- Source: EIA Form 860b, 2000





Marketplace Conclusions

- Big potential market for TAT
- Indirect-fired units add value when integrated into IES with CHP
  - Increases value of CHP waste heat
  - Provides summer load for waste heat, opening up difficult to crack building markets
- Direct-fired market may become large scale
  - Promotion needs to emphasize benefits of segregating latent and sensible loads
  - Superior humidity control is key
  - Reaching larger markets can lower capital cost by increasing production volumes
- Development should be balanced on both applications

Why We're Here - Objectives

DOE Perspective

Story/Strategy… quantitative facts

- Environmental solution?- NCCTI
- Demand response- cooling/air conditioning
- Fuel independence/flexibility
- Champions in the marketplace
  - Merchant industries
  - Residences
  - Light manufacturing

- Utilize lessons learned from CHP, thermal storage, DER strategies….make sure it's integrated

U.S. DOE's RD&D Role

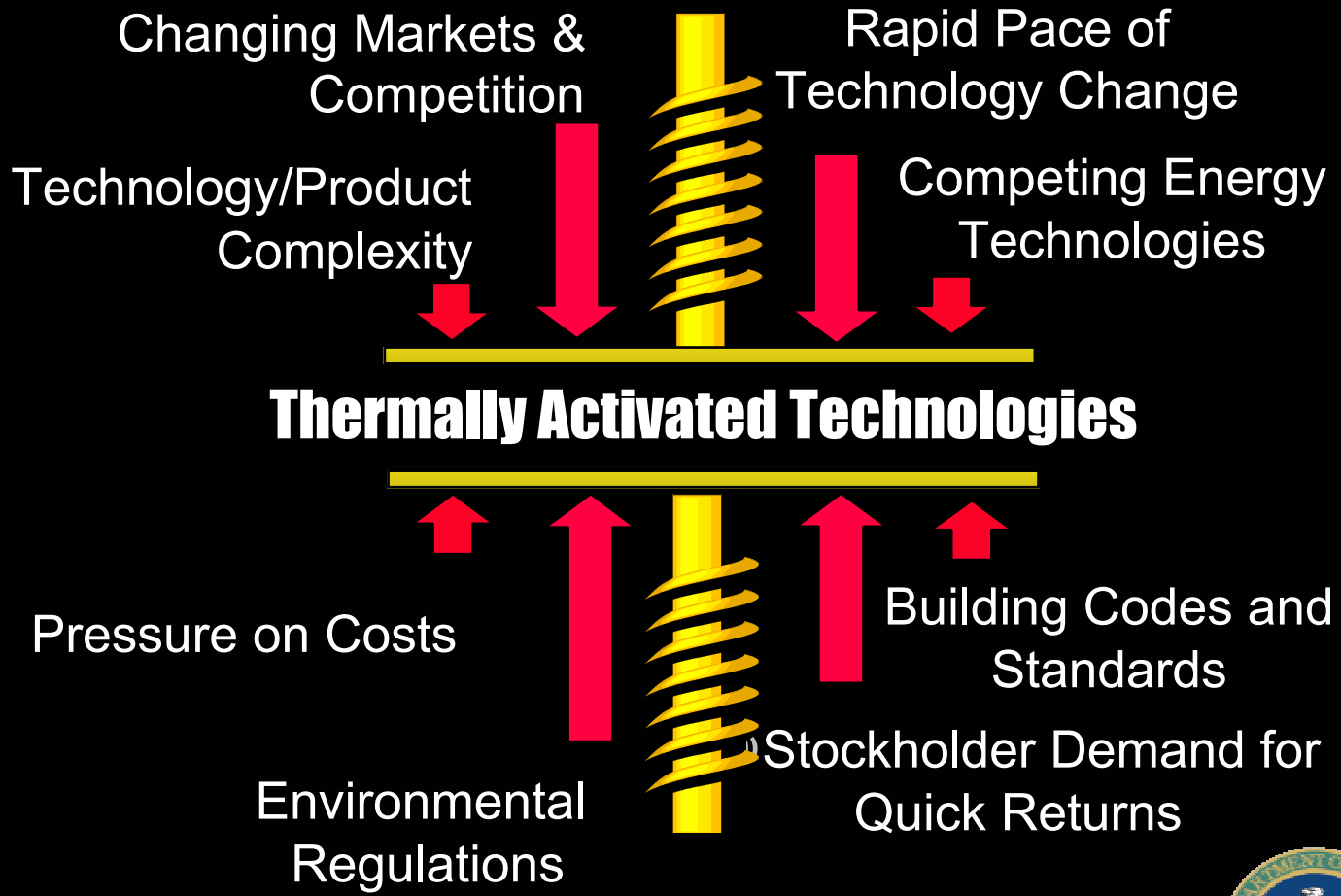
DOE Perspective

- Incremental energy efficiency and delivery improvements are essential for the nation's competitiveness and largely the preview of industry

- Leap frog change in energy efficiency, delivery, and use will keep America in the global lead and is the focus of DOE's RD&D approach

The challenges we face

TIME IS NOW



TAT - One of the keys to our energy future